

**ERIC W. CHRISTENSEN, PHD**  
**ECONOMIST**  
16889 HUBBARD TRAIL  
LAKEVILLE, MN 55044  
christensen.ericw@gmail.com  
703-244-3224

---

September 13, 2023

David Bona, Esq.  
Carlson, Calladine & Peterson LLP  
One Post Street, Suite 500  
San Francisco, CA 94104

**Re: William Jerome Ruth, et al. v. Beartooth Electric Cooperative, Inc., et al.**

Dear Mr. Bona:

Per your request, I have computed potential economic values for Cynthia Ruth who died on November 16, 2021. This report (1) provides my own estimates of potential economic values for Ms. Ruth and (2) critiques the economic damages report provided by Dr. David Rosenbaum, dated May 8, 2023. Note that in providing these estimates of potential economic losses associated with Ms. Ruth's death, I have no opinion regarding the cause thereof.

Please see my CV for a list of my qualifications and experience.

**Present value of potential earnings losses**

Estimating the present value of potential earnings losses requires the following: evaluation of earning capacity, employer-provided benefits, worklife expectancy, personal consumption, and net discount rate.

**Earning capacity.** Ms. Ruth worked as a physical therapy for the Children's Resource Center. Her tax records for the years 2017 through 2021 show declining annual earnings over this period (Table 1). Flat to declining real earnings for individuals of Ms. Ruth's age are consistent with the age earnings profile.<sup>1</sup>

---

<sup>1</sup> Typically, wage growth is more rapid when workers are young. This above average wage growth reflects their acquisition of skills, knowledge, and experience during the early years of their careers. However, workers' wage growth slows mid-career, resulting in essentially no real wage growth. This does not mean they do not experience wage growth after the mid-career point, but this wage growth is on average about the same as cost-of-living increases. In other words, their wage growth just keeps up with inflation, resulting in no real increase in purchasing power. The earnings pattern by age, education level, and gender, where wages are expressed in real dollars (i.e., purchasing power), is called the age earnings profile.

**Table 1.** Earning history, 2017-2021

Year	Earnings
2017	82,911
2018	77,369
2019	75,586
2020	71,525
2021	70,219

Ms. Ruth's employment contracts from the 2010-2011 to 2021-2022 period show her contract compensation as detailed in Table 2. Over this period, her hourly wage increased 1.50% per annum and her annual days worked per year fell from 205 in 2010-2011 to 173.5 in 2021-2022. Comparing her contract earnings with her earnings from her tax returns, I estimate that her annual earnings are 1.0101 times her contract earnings. Accordingly, I estimate her 2022 earnings at \$68,580. Growing these earnings by 1.50%, her estimated earnings in 2023 are \$69,608.

**Table 2.** Contract earnings, 2010-2011 to 2021-2022

Period	Hourly	Hours per day	Days	Salary	Discretionary	Total
2010-2011	\$45.00	7	205	\$64,575		\$64,575
2011-2012	\$45.00	7	205	\$64,575		\$64,575
2012-2013	\$45.00	7	205	\$64,575		\$64,575
2013-2014	\$50.00	7	205	\$71,750		\$71,750
2014-2015	\$50.00	7	205	\$71,750		\$71,750
2015-2016	\$50.00	7	205	\$71,750		\$71,750
2016-2017	\$50.00	7	205	\$71,750		\$71,750
2017-2018	\$53.00	7	205	\$76,055		\$76,055
2018-2019	\$53.00	7	190	\$70,490		\$70,490
2019-2020	\$53.00	7	190	\$70,490		\$70,490
2020-2021	\$53.00	7	190	\$70,490		\$70,490
2021-2022	\$53.00	7	173.5	\$64,369	\$3,525	\$67,893
Per annum	1.50%					

**Employer-provided Benefits.** Earning capacity includes employer provided fringe benefits. In addition to legally required benefits for Social Security, Medicare, and unemployment insurance, benefits may include health insurance and retirement contributions. Based on Ms. Ruth's employment contracts, she received an annual \$4,000 benefits contribution in addition to legally required benefits. I have estimated legally required benefits at 8.96% of earnings based on *Employer Costs for Employee Compensation – June 2023* from the Bureau of Labor Statistics.<sup>2</sup>

**Worklife expectancy.** The economic literature shows that worklife expectancy is a function of age, education level, and gender. I have applied worklife expectancy values appropriate to Ms.

---

<sup>2</sup> *Employer Costs for Employee Compensation – June 2023*, Bureau of Labor Statistics, U.S. Department of Labor, USDL-23-1971, September 12, 2023, Table 1.

Ruth based on Skoog et al. (2019).<sup>3</sup> Based on this study, the worklife expectancy of a female of Ms. Ruth's age with a bachelor's degree is to age 67.9 years.

**Personal consumption.** Potential earning capacity needs to be reduced by the amount Ms. Ruth would have used or consumed to support herself, which we call personal maintenance. The U.S. Census Bureau conducts the Consumer Expenditure Survey, which reflects actual spending by households. Expenditure categories include housing, food, transportation, clothing, etc. The percentage of a household's income consumed by one individual depends on the number of people in the household and the total household income level. For example, when there is only one person in the household, all housing expenditures are attributable to that individual as personal consumption or maintenance. However, with two or more individuals in the household, some of these expenditures are assumed to be fixed and would not decrease if the household was reduced by one person.

Accordingly, I used data from the Consumer Expenditure Survey to compute the percentage of household income that is consumed by an adult in the household depending on the household's income and the number of people in the household.<sup>4</sup> Note that personal consumption is a percentage of household income, not individual income.<sup>5</sup>

Similarly, benefits are subject to self-consumption. For benefits, I have applied personal consumption using the same percentage used for earnings.

**Net discount rate.** The purpose of computing the present value of future values is to provide a lump sum today that, when invested in safe investments, will provide the same purchasing power as the stream of future values. Net discount rates allow one to simultaneously account for growth rates (inflation) and bond yields, given the historically stable relationship between inflation and bond yields.<sup>6</sup> When one rises, the other typically rises. When one falls, the other typically falls. In other words, they move together. The exact net discount rate used should reflect the length of the future period. Typically, the shorter the future period, the lower the net discount rate. In this instance, I have used a net discount rate of 0.5% to compute the present value of earnings losses. This net discount rate reflects both the current and long-term net discount rates based on inflation and 1-year U.S. Treasury notes.

**Summary of potential earnings losses.** Exhibit 1 shows that the present value of Ms. Ruth's potential earnings losses is \$404,487 in 2023 dollars. This value reflects her estimated earnings through her worklife expectancy less personal consumptions of these earnings.

<sup>3</sup> Skoog, Gary R., James E. Ciecka, and Kurt V. Krueger. 2019. "The Markov Model of Labor Force Activity 2012-17: Extended Tables of Central Tendency, Shape, Percentile Points, and Bootstrap Standard Errors". *Journal of Forensic Economics*, 28(1): 15-108.

<sup>4</sup> Christensen, Eric W. "Personal Consumption and Personal Maintenance Estimates Using Empirically Based Expenditure Allocation Rules", *Journal of Legal Economics*, forthcoming. See also Ruble, Michael R., Robert T. Patton, and David M. Nelson. 2019. "Patton-Nelson Personal Consumption Tables 2016-17", *Journal of Legal Economics*, 25(1-2): 75-89.

<sup>5</sup> I have estimated household income based on Mr. and Ms. Ruth's tax records from 2017 through 2021. Average household income in 2021 dollars over this period is \$134,812 annually.

<sup>6</sup> Christensen, Eric W. 2019. "Stationarity of Net Discount Rates: Review of the Literature and New Evidence", *Journal of Legal Economics*, 25(1-2): 29-51.

## Present value of potential household services losses

Household services include household chores in and outside the home and caring for and helping other household members. Computing the present value of potential household services losses requires estimating the following: level and value of household services, life expectancy, personal consumption, and net discount rate.

**Level and value of household services.** I have estimated Ms. Ruth's household services values based on data from the American Time Use Survey from the Bureau of Labor Statistics as compiled in *The Dollar Value of a Day, 2020 Dollar Valuation* (DVD 2020). This publication reports hours per day spent in various tasks and that these hours vary by the characteristics of the individual and the household. These characteristics include marital status, employment status, and age of the youngest child.

Accordingly, I have estimated Ms. Ruth's household services values using average values for married women, who are employed fulltime, whose spouse is employed, aged 55 or more, and living with their spouse only (DVD 2020 Table 139) until she reaches her worklife expectancy. Once retired, I have estimated household services values using average values for retired married women, aged 62-74 years (DVD Table 256) and aged 75 or more (DVD Table 257) until Mr. Ruth's life expectancy. After Mr. Ruth's life expectancy, I have estimated household services values based on average values for retired single women aged 75 or more who live alone (DVD 2020 Table 365).

Note that hourly values of household services in DVD 2020 represent a national average. I have adjusted these values to reflect wage differences between the western Wyoming non-metropolitan area and the national average. See Exhibit 2 for additional details.

**Life expectancy.** Household services values are computed through an individual's life expectancy. I have estimated Ms. Ruth's life expectancy using the 2020 United States Life Tables for females.<sup>7</sup> On this basis, her life expectancy is to age 84.2 years.

**Personal consumption.** Household services are both jointly produced and jointly consumed by all household members. Some of the services an individual household member provides will be for his or her exclusive benefit, some services will be for the exclusive benefit of other household members, and some will be for the benefit of the entire household. If the surviving household members are to be made whole with respect to household services, the household services that the individual would have exclusively consumed (i.e., personal consumption) need to be removed. Hence, estimating personal consumption of household services requires estimating the household services values provided by all household members that would have been exclusively consumed by the decedent. Note that in cases where the decedent lived alone, other family members (i.e., parents, siblings, children) would not benefit from the household services the decedent would have produced because the decedent and other family members lived in different households.<sup>8</sup>

---

<sup>7</sup> Arias, Elizabeth and Jiaquan Xu. *United States Life Tables, 2020*. National Vital Statistics Reports, 71(1), August 8, 2022, Table 3.

<sup>8</sup> See Baade, Robert A., and Victor A. Matheson. 2007. "Research Note: Assessing Household Service Losses with Joint Survival Probabilities." *Journal of Forensic Economics*, 20(2): 187-192.

Note that the hours for household services from DVD 2020 include hours caring for and helping non-household members. If we assume that hours caring for and helping non-household members are, by definition, not household services, these hours should be excluded. I have applied personal consumption values appropriate to Ms. Ruth's household.<sup>9</sup>

**Net discount rate.** I applied a net discount rate 1.4% to compute the present value of potential household services losses. This net discount rate is higher than that used for computing the present value of earnings so that it reflects the longer future period for household services values.

**Summary of potential household services losses.** Exhibit 2 shows the present value of potential household services losses for Ms. Ruth is \$237,369, if household services hours exclude services directed to non-household members. If these hours are included, the present value is \$273,325.

### Critique of David Rosenbaum estimates

Dr. Rosenbaum estimated the present value of Ms. Ruth's potential earnings losses at \$501,049. My critique of this estimate is as follows.

First, he estimated Ms. Ruth's earnings through age 71, which is 3.1 years beyond her worklife expectancy.

Second, Dr. Rosenbaum increased future earnings and benefits at 3% annually. Ms. Ruth's hourly wage increased only 1.5% per annum between 2010-2011 and 2021-2022 and her employer benefits contribution did not increase over this period.

Third, he did not consider legally required benefits and applied a deduction for federal taxes.

Dr. Rosenbaum estimated the present value of Ms. Ruth's potential household services losses at \$449,747. My critique of this estimate is as follows:

First, Dr. Rosenbaum appropriately did not compute household services losses following Mr. Ruth's life expectancy as she would have self-produced and self-consumed all of these household services; however, he did not account for any personal consumption of household services prior to Mr. Ruth's life expectancy.

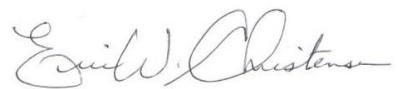
Second, he estimated Ms. Ruth's household services hours based on a discussion with Mr. Ruth. On a weekly basis, these hours are one-third higher than the average household services hours for women comparable to Ms. Ruth.<sup>10</sup> Clearly some individuals are above and some below the average, but I note that these hours are one-third higher than the average as a reference point for the trier of fact.

It is recognized that, as this case progresses, my opinions may need to be updated based on additional information that may become available.

<sup>9</sup> Christensen, Eric W. "Personal Consumption of Household Services." *Journal of Forensic Economics*, 30(1): 31-61.

<sup>10</sup> As an illustration, I have estimated potential household services losses using the annual amounts provided by Dr. Rosenbaum that were based on his discussion with Mr. Ruth, but I have accounted for personal consumption of household services where Dr. Rosenbaum did not. Doing so, the present value of lost household services would be \$268,302. This figure is directly comparable to my estimate of \$237,369.

Sincerely,

A handwritten signature in black ink, appearing to read "Eric W. Christensen".

Eric W. Christensen, PhD

**Exhibit 1. Potential earnings losses**

	Date	Age	Year
Date of birth	04/11/60		1960.28
Date of death	11/16/21	61.60	2021.88
Date of present value	12/31/23	63.72	2024.00
Worklife expectancy		67.90	2028.18 Skoog et al. (2019), Table 28

Earnings, 2021	73,192
Earnings, 2021-2022	68,580
Household income, 2021	134,812
Growth, 2022 & 2023	1.50%
Legally required benefits	8.96% ECEC - June 2023
Net discount rate	0.50%

Year	Age year end	Fraction of year	Household income	Personal			PV of net loss	
				Earnings	Benefits	consump.	Net loss	loss
2021	61	0.12	16,177	2,973	746	1,532	2,187	2,187
2022	62	1.00	136,834	68,580	10,145	13,775	64,949	64,949
2023	63	1.00	138,886	69,608	10,237	14,196	65,649	65,649
2024	64	1.00	138,886	69,608	10,237	14,196	65,649	65,486
2025	65	1.00	138,886	69,608	10,237	14,196	65,649	65,160
2026	66	1.00	138,886	69,608	10,237	14,196	65,649	64,836
2027	67	1.00	138,886	69,608	10,237	14,196	65,649	64,513
2028	68	0.18	25,277	12,669	1,863	2,584	11,948	11,707
<b>Total</b>							<b>404,487</b>	

**Exhibit 2. Potential household services losses**

	Date	Age	Year	
Date of birth	04/11/60		1960.28	
Date of death	11/16/21	61.60	2021.88	
Date of present value	12/31/23	63.72	2024.00	
Worklife expectancy		67.90	2028.18	Skoog et al. (2019), Table 28
Life expectancy		84.20	2044.48	NVSR 71(1), Table 3
Mr. Ruth				
Date of birth	02/15/58		1958.13	
Ms. Ruth DOD	11/16/21	63.75	2021.88	
Life expectancy		81.70	2039.83	NVSR 71(1), Table 2

	DVD table	Weekly hours	Hourly rate	Location factor	Adjusted hourly rate	Annual, 2020\$	Annual, 2023\$
Married women, empl. FT, spouse empl., 55+, spouse only	139	23.32	\$16.33	0.9997	\$16.33	\$19,797	\$23,363
Portion directed to non-household members		2.38	\$16.31	0.9997	\$16.30	\$2,017	\$2,381
Portion directed to household members		20.94	\$16.33	0.9997	\$16.33	\$17,780	\$20,982
Married women, retired, spouse not empl., 62-74, spouse only	256	32.32	\$16.29	0.9997	\$16.28	\$27,365	\$32,293
Portion directed to non-household members		2.71	\$16.18	0.9997	\$16.17	\$2,279	\$2,690
Portion directed to household members		29.61	\$16.30	0.9997	\$16.29	\$25,085	\$29,604
Married women, retired, spouse not empl., 75+, spouse only	257	29.05	\$16.15	0.9997	\$16.14	\$24,387	\$28,780
Portion directed to non-household members		0.88	\$16.35	0.9997	\$16.34	\$748	\$883
Portion directed to household members		28.17	\$16.14	0.9997	\$16.14	\$23,639	\$27,897
Single women, retired, 75+, living alone	365	23.39	\$16.56	0.9997	\$16.56	\$20,140	\$23,767
Portion directed to non-household members		1.37	\$16.31	0.9997	\$16.30	\$1,161	\$1,371
Portion directed to household members		22.02	\$16.58	0.9997	\$16.57	\$18,978	\$22,397

Year	Inflation	Net discount rate	1.40%
2021	4.70%		
2022	8.00%		
2023	4.36%		

Year	Age, year end	Fraction of year	Household services including hours for non-household members				Household services excluding hours for non-household members			
			Household services	Personal consump.	Personal consump.	PV of net loss	Household services	Personal consump.	Personal consump.	PV of net loss
2021	61	0.12	2,487	49.7%	1,236	1,251	1,251	55.3%	1,235	999
2022	62	1.00	22,386	49.7%	11,126	11,260	11,260	55.3%	11,118	8,987
2023	63	1.00	23,363	49.7%	11,611	11,752	11,752	55.3%	11,603	9,379
2024	64	1.00	23,363	49.7%	11,611	11,752	11,670	55.3%	11,603	9,379
2025	65	1.00	23,363	51.8%	12,102	11,261	11,029	54.7%	11,477	9,505
2026	66	1.00	23,363	51.8%	12,102	11,261	10,876	54.7%	11,477	9,505
2027	67	1.00	23,363	51.8%	12,102	11,261	10,726	54.7%	11,477	9,505
2028	68	1.00	32,293	37.4%	12,078	20,216	18,990	40.1%	11,871	17,733
2029	69	1.00	32,293	37.4%	12,078	20,216	18,728	40.1%	11,871	17,733
2030	70	1.00	32,293	37.4%	12,078	20,216	18,469	40.1%	11,871	17,733
2031	71	1.00	32,293	37.4%	12,078	20,216	18,214	40.1%	11,871	17,733
2032	72	1.00	32,293	37.4%	12,078	20,216	17,962	40.1%	11,871	17,733
2033	73	1.00	32,293	37.4%	12,078	20,216	17,714	40.1%	11,871	17,733
2034	74	1.00	32,293	37.4%	12,078	20,216	17,470	40.1%	11,871	17,733
2035	75	1.00	28,780	37.4%	10,764	18,016	15,354	40.1%	11,187	16,710
2036	76	1.00	28,780	37.4%	10,764	18,016	15,142	40.1%	11,187	16,710
2037	77	1.00	28,780	37.4%	10,764	18,016	14,933	40.1%	11,187	16,710
2038	78	1.00	28,780	37.4%	10,764	18,016	14,727	40.1%	11,187	16,710
2039	79	1.00	28,780	37.4%	10,764	18,016	14,524	40.1%	11,187	16,710
2040	80	1.00	23,767	96.9%	23,038	729	579	100.0%	22,397	0
2041	81	1.00	23,767	96.9%	23,038	729	571	100.0%	22,397	0
2042	82	1.00	23,767	96.9%	23,038	729	564	100.0%	22,397	0
2043	83	1.00	23,767	96.9%	23,038	729	556	100.0%	22,397	0
2044	84	0.48	11,408	96.9%	11,058	350	264	100.0%	10,750	0
<b>Total</b>						<b>273,325</b>				<b>237,369</b>